CLAIMS:

1. A nanocomposite comprising:

(a) a nano-reinforcing material;

(b) a polymer matrix; and,

(c) an epoxy-functionalized graft polymer compatible with the polymer matrix.

2. The nanocomposite according to claim 1, wherein the nano-reinforcing material is layered clay, nano-fibers, nano-whiskers, carbon nanotubes, metal-oxide nanotubes, metallic oxides, metallic sulfides, metallic layered hydroxides, or a mixture thereof.

3. The nanocomposite according to claim 1, wherein the nano-reinforcing material is mineral or synthetic layered silicate.

4. The nanocomposite according to claim 1, wherein the nano-reinforcing material is a phyllosilicate.

5. The nanocomposite according to claim 1, wherein the nano-reinforcing material is bentonite, kaolinite, dickite, nacrite, stapulgite, illite, halloysite, montmorillonite, hectorite, fluorohectorite, nontronite, beidellite, saponite, volkonskoite, magadiite, medmontite, kenyaite, sauconite, muscovite, vermiculite, mica, hydromica, phegite, brammallite, celadonite, or a mixture thereof.

6. The nanocomposite according to claim 1, wherein the nano-reinforcing material is modified with quaternary, ternary, secondary or primary ammonium or phosphonium.

7. The nanocomposite according to claim 1, wherein the polymer matrix comprises a thermoplastic polymer, a thermoset polymer, an elastomer or a mixture thereof.

8. The nanocomposite according to claim 1, wherein the polymer matrix comprises an olefinic, a vinylic, a styrenic, an acrylonitrilic, an acrylic, a cellulosic, a polyamide, a thermoplastic polyester, a thermoplastic polycarbonate, a polysulfone, a polyimide, a polyether/oxide, a polyketone, a fluoropolymer, a copolymer of the foregoing, or a mixture thereof.

9. The nanocomposite according to claim 1, wherein the polymer matrix comprises an olefinic, a polyamide, a thermoplastic polyester, a thermoplastic polycarbonate, a copolymer of the foregoing, or a mixture thereof.

10. The nanocomposite according to claim 1, wherein the polymer matrix comprises an olefinic homopolymer, an olefinic copolymer, thermoplastic polyester, a polyamide, a copolymer of a polyamide, an elastomer, a copolymer of an elastomer, or a mixture thereof.

11. The nanocomposite according to claim 1, wherein the polymer matrix comprises polypropylene, polyethylene, ethylene-propylene copolymer, polyethylene-terephthalate, polyamide, or a mixture thereof.

12. The nanocomposite according to claim 1, wherein the polymer matrix comprises polypropylene.

13. The nanocomposite according to claim 1, wherein the epoxy-functionalized graft polymer comprises a matrix compatible portion and an epoxy-functionalized portion.

14. The nanocomposite according to claim 1, wherein the epoxy-functionalized graft polymer comprises a matrix compatible portion that is the same as the polymer matrix.

15. The nanocomposite according to claim 1, wherein the epoxy-functionalized graft polymer comprises an epoxy-functionalized portion that comprises a glycidyl group.

16. The nanocomposite according to claim 1, wherein the epoxy-functionalized graft polymer comprises a glycidyl methacrylate grafted polymer or copolymer.

17. The nanocomposite according to claim 1, wherein the epoxy-functionalized graft polymer comprises an epoxy modified-coupling agent-grafted polymer or copolymer.

18. The nanocomposite according to claim 1, wherein the epoxy-functionalized graft polymer comprises a glycidyl methacrylate grafted polypropylene.

19. The nanocomposite according to claim 1, wherein the epoxy-functionalized graft polymer comprises a glycidyl methacrylate modified styrene-grafted polypropylene.

20. The nanocomposite according to claim 1, wherein the nano-reinforcing material comprises layered clay modified with quaternary, ternary, secondary or primary ammonium or phosphonium, the polymer matrix comprises polypropylene, and the epoxy-functionalized graft polymer comprises glycidyl methacrylate grafted polypropylene.

21. The nanocomposite according to claim 1, wherein the nano-reinforcing material comprises layered clay modified with quaternary, ternary, secondary or primary ammonium or

phosphonium, the polymer matrix comprises polypropylene, and the epoxy-functionalized graft polymer comprises an epoxy-modified-maleic anhydride-grafted polypropylene or an epoxy-modified-acrylic acid-grafted polypropylene.

22. The nanocomposite according to claim 1, wherein the nano-reinforcing material comprises layered clay modified with quaternary, ternary, secondary or primary ammonium or phosphonium, the polymer matrix comprises polyethylene terephthalate, and the epoxy-functionalized graft polymer comprises epoxy-functionalized polyethylene terephthalate.

23. The nanocomposite according to claim 1, wherein functional groups pendant from the epoxy-functionalized graft polymer have been fully or partially transformed into epoxy groups.

24. The nanocomposite according to claim 1, wherein the nano-reinforcing material is present in an amount of from about 0.1 to about 40 weight percent based on the total weight of the nanocomposite.

25. The nanocomposite according to claim 1, wherein the amount of nano-reinforcing material is from about 0.2 to about 30 weight percent based on the total weight of the nanocomposite.

26. The nanocomposite according to claim 1, wherein the amount of nano-reinforcing material is from about 0.5 to about 20 weight percent based on the total weight of the nanocomposite.

27. The nanocomposite according to claim 1, wherein polymer matrix is present in an amount of from about 0.1 to

about 99.9 weight percent based on the total weight of the nanocomposite.

28. The nanocomposite according to claim 1, wherein the amount of polymer matrix is from about 20 to about 99.0 weight percent based on the total weight of the nanocomposite.

29. The nanocomposite according to claim 1, wherein the amount of polymer matrix is from about 40 to about 98.0 weight percent based on the total weight of the nanocomposite.

30. The nanocomposite according to claim 1, wherein the epoxy-functionalized graft polymer is present in an amount of from about 0.1 to about 99.9 weight percent based on the total weight of the nanocomposite.

31. The nanocomposite according to claim 1, wherein the amount of epoxy-functionalized graft polymer is from about 0.5 to about 90.0 weight percent based on the total weight of the nanocomposite.

32. The nanocomposite according to claim 1, wherein the amount of epoxy-functionalized graft polymer is from about 1.0 to about 80 weight percent based on the total weight of the nanocomposite.

33. A process for producing a nanocomposite comprising:

(a) selecting a polymer matrix;

(b) selecting a nano-reinforcing material;

(c) selecting an epoxy-functionalized graft polymer having a matrix compatible portion selected to be compatible with the polymer matrix and having an epoxy-functionalized

portion selected to be able to interact with surface and/or modified groups of the nano-reinforcing material; and,

(d) preparing the nanocomposite.

34. The process according to claim 33, wherein the matrix compatible portion is selected based on a property of the polymer matrix, the property being selected from the group consisting of a physical property, a chemical property, chemical structure, or a combination thereof.

35. The process according to claim 33, wherein the matrix compatible portion is selected based on a property of the polymer matrix, the property being selected from the group consisting of crystallinity, hydrophobicity, cohesive energy density, capacity for dispersive interactions, capacity for polar interactions, capacity for hydrogen bonding interactions, capacity for acid/base interactions, or a combination thereof.

36. The process according to claim 33, wherein the nano-reinforcing material comprises layered clay.

37. The process according to claim 33, wherein the polymer matrix comprises a thermoplastic polymer, an elastomer or a mixture thereof.

38. The process according to claim 33, wherein the polymer matrix comprises a polyolefin.

39. The process according to claim 33, wherein the polymer matrix comprises polypropylene.

40. The process according to claim 33, wherein the epoxy-functionalized graft polymer has a matrix compatible portion

which comprises a thermoplastic polymer, an elastomer or a mixture thereof.

41. The process according to claim 33, wherein the epoxy-functionalized graft polymer has a matrix compatible portion which comprises a homopolymer or copolymer of a polyolefin.

42. The process according to claim 33, wherein the epoxy-functionalized graft polymer has a matrix compatible portion which comprises polypropylene.

43. The process according to claim 33, wherein the epoxy-functionalized graft polymer has a matrix compatible portion which comprises a homopolymer or copolymer of a thermoplastic polyester or polyamide.

44. The process according to claim 33, wherein the epoxy-functionalized graft polymer has a matrix compatible portion which comprises polyethyleneterephthalate, polyamide, polyethylene, or ethylene-propylene copolymer.

45. The process according to claim 33, wherein the epoxy-functionalized graft polymer has an epoxy-functionalized portion comprising a glycidyl group.

46. The process according to claim 33, wherein the epoxy-functionalized graft polymer has an epoxy-functionalized portion comprising glycidyl methacrylate.

47. The process according to claim 33, wherein the epoxy-functionalized graft polymer has an epoxy-functionalized portion comprising diglycidyl ether of bis-phenol A, diglycidyl ether of p-aminophenol, or N,N,N',N'-tetraglycidyl-4,4'-methylene-bis-benzene amine.

48. The process according to claim 33, wherein the nanocomposite is formed by melt blending the polymer matrix, the nano-reinforcing material and the epoxy-functionalized graft polymer.

49. The process according to claim 48, wherein the melt blending is performed in an extruder, an injection molding machine, an internal mixer, an extensional mixer or a continuous mixer.

50. The process according to claim 33, wherein the polymer matrix is formed by polymerizing a monomer and/or oligomer of the polymer matrix in the presence of the nano-reinforcing material and the epoxy-functionalized graft polymer.